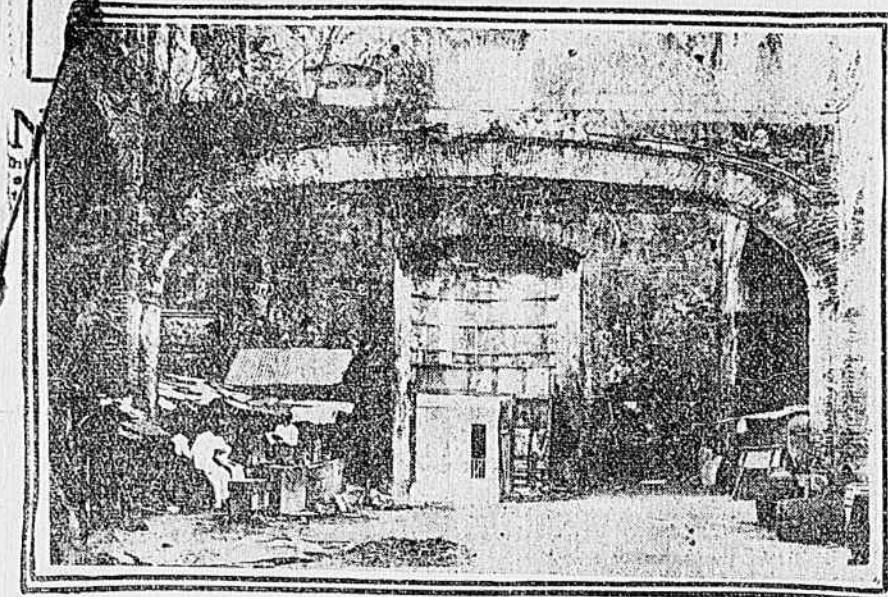
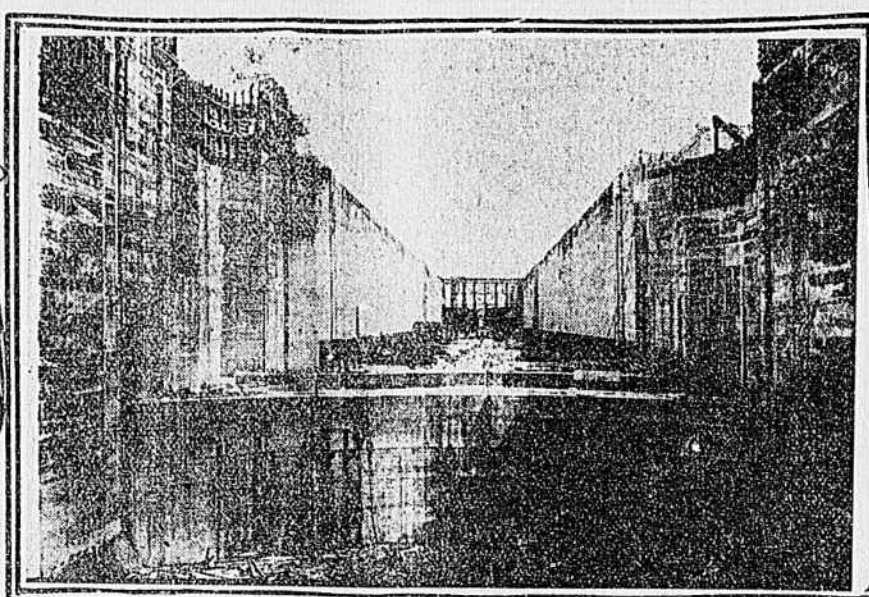


## Col. Goethals Talks of His Work On Panama Canal



No danger of earthquakes. "That arch is 200 years old."



Seismograph Station, Gatun Lake. "We keep records of the earth's tremors."



COLONEL G. W. GOETHALS. He is the supreme manager of all things on the isthmus.

Sitting here on the hill of Culebra, high over the mighty canal, looking down upon the busy Sunday quiet or what for six days of the week is the busiest and noisiest place upon earth, I have had a chat with Colonel George W. Goethals as to our mighty canal and its future.

There is no man who can speak more intelligently and more authoritatively about the canal than Colonel Goethals. He is the supreme manager of all things on the isthmus. His title is chairman of the canal commission and chief engineer, but he is far more than that. Under the powers granted him by the President, he is the dictator, the administrator, the executive, and, in short, the ultimate authority to whom all others must bow. His position may be said to be a glove of velvet and the thousands of rules may not appreciate its existence, but if they disobey it strikes and crushes the offender.

Such authority has been found absolutely necessary to the canal construction. The lack of it would be a great extent the causes of the resignations of Chief Engineers Wallace and Stevens. It tied their arms and those of their subordinates with the government red tape of caprice and custom, and swathed this mighty industrial entity, the whole canal force, with hands stronger than those with which the Lilliputians bound the giant Gulliver. When Colonel Goethals first came, he found himself in a network like Gulliver's, and it was only by presenting the matter to President Roosevelt, who had watched the vain and chaotic struggles of the past, that he was able to get the power which has enabled him to accomplish the mighty work which every one now recognizes as his.

**The Square Deal at Panama.** More than this, Colonel Goethals has used his authority so that his thousands of employees are glad to obey. He has brought harmony out of discord among the American employees and has done the same with the thirty odd thousand Central Americans, Jamaicans and other West Indians. He has not only preached the square deal, but he has given the square deal to every one, and with the exception of a few constitutional kickers, all are satisfied. Every Sunday morning the

chairman holds a little supreme court of appeals here in his office in the administration building. He is both judge and jury, and any one who will, even to the blackest and poorest of the laborers who handle the picks or wade the mud, may come and present his complaint. The chairman investigates the trouble, and the judgment is usually such that the man goes away satisfied.

**The Working Ruler.** Colonel Goethals is a working dictator. He knows every bit of the canal construction by close contact with the men and the machinery. He goes over some part of the work every day. He starts out at 7 o'clock in the morning and walks to those places where he is most needed, talking with the men and directing the foremen. He knows each branch of the engineering construction as well as the division engineer in charge, and has, in short, a complete grasp of this mighty job

as a whole and in detail. I might fill this letter with stories about him which illustrate his characteristics. I might tell you how he looks, a gray-headed giant of fifty, with eyes as blue as the Panama sky and muscles which are lifting mountains in the cut far below me. I might speak of his nerve and determination to get things done, and of his motto, which and that everything and everybody must be pushed to all costs, and that everything and everybody must be pushed to all costs, and that everything and everybody must be pushed to all costs.

Our conversation covered a wide range. Colonel Goethals knows the canal so well that he could talk most interestingly for an hour or more about any of its features. I have room here for only a part of our chat. We had been discussing the mighty locks at each end of the waterway which will lift the ships to the level of the great cut which lay there below us, and I asked whether, after all, it would not have been better to have made the cut deeper and have created a sea-level canal.

Colonel Goethals replied: "No, the lock canal is by far the better, and it will prove to be the more permanent and the more economical in its operation. If the government had decided upon a sea-level canal that great gorge below us would have had to be cut eighty-five feet deeper than it is now. Besides, I do not believe that the people of the United States would have stood for the additional time and cost which would have been necessary to make it, and that is supposing it were at all possible to have made it. When I came here I had a pretty well fixed idea that the sea-level canal might be the better, but my experience has changed that opinion, for I do not believe that we could have constructed it on account of the immensely greater slides which we would have had if we had deepened the cut. As it is now we shall be able to control the slides, and I do not apprehend that they will cause any great damage to the completed canal."

**The Slides of the Future.** "Tell me something about these slides, Colonel. What makes you think they will disappear when the canal is completed?" "We know because we have studied the geological structure of this part of the mountains. We have studied the pressure of the earth, and how the land moves. We have experimented and know that when we have given the sides of the canal prism a natural slope that the earth will be as firm as that of the hills all about us. Such slides are caused by the great weight of earth above and back of the excavation which forces these bodies of earth down into the cut and at the same time presses it upward from the bottom of the canal. By the right slope this great pressure will be removed, and when that is done there seems to be no reason why the ground should not be firm for all time to come. Besides slides of this kind move very slowly, and the probability is that any may occur can easily be handled by the dredges so as to keep the canal clear. I would say also that we are strengthening the walls by earth binders in the shape of various grasses and plants. They will soon be covered with jungle, and this will further lessen the danger."

**No Fear of Earthquakes.** "But how about earthquakes?" I asked. "We have also considered that possibility," replied Colonel Goethals. "We have seismographs here by which we keep records of the earth's tremors, and we also have reports of such machines the world over. We have records of the earthquake at San Francisco, and of the shakes which occurred then at St. Louis and other places about the same time. We have found that the same trembling of the earth occurs at such times in Washington city, and I have decided that it is only when I hear that the National Capitol has fallen that I shall need to have any great alarm about the

"The lock canal is by far the better. It will be more permanent and more economical."

canal. No, the earthquakes are not frightening me at all."

"But are you not in the earthquake belt?" "We have never had any great disturbance at Panama, although the belt seems very pronounced in Costa Rica, just north of here. As an evidence of the stability of construction on the isthmus you must have seen the arch in the old church at Panama. It is the widest, lowest and nearest horizontal of any arch known to architecture. It is, perhaps, forty feet long, and consists of one span without any support except at the ends. That arch is 200 years old, and it is still firm, notwithstanding most of the church is in ruins."

"I would say, however, that the Panamanians have a tradition that that arch fell twice during its construction, and that at last, in despair, the monk who was the architect got down on his knees and prayed to the Lord to help him. In his prayer he said that he would build the arch once more, and he begged the Lord to cause it to stand, although the rest of the church might crumble to atoms. Many of the natives believe that prayer is the cause of the stability of the arch. Some of our Catholic friends are now erecting a church here on the spot. If that will make the earth more firm and strengthen Culebra I should be glad to have them cover the hills of the cut with churches from one end to the other. Seriously speaking, I do not think there is any danger from earthquakes."

**The Great Dam and Lake Gatun.** "But, Colonel, are you sure as to the Gatun Dam? Will it be strong enough to hold back that 161 square miles of water which will be stored up in the lake?"

"There is no doubt about the dam," said Colonel Goethals. "It has been made according to the regulations which provided that it should be a barrier which would convince beyond doubt both legislators and laymen of its stability. I believe we could have made a dam of less size for less money which would have satisfied the engineers, but the designers considered this dam desirable, and it has been constructed. The factor of safety in it is far beyond the absolute necessity. There has been a great interest in the dam, and it has been given more prominence among the engineering features of the canal than is warranted by its construction. It is nothing but a hill built across the valley with the spillway in the middle. You understand how it is made. We have formed two great dumps of the waste material, mostly the rock from Culebra and the lock site and Mindi on the outer lines of the structure, and have filled in the space between these dumps with the material from the hydraulic dredges. The spillway is so arranged that it controls the height of the lake, and at the same time gives us electric power sufficient for the machinery of the canal, including the locks. The locks are among the most interesting features."

**The Canal Cost to Be Less Than \$375,000,000.** "What will be the probable cost of the canal when it is completed?" "That will depend very much on the accessories, such as dry-docks, terminals, coaling stations and supply houses. It will certainly be less than \$375,000,000."

**Watching the Leaks and Scientific Management.** "But how can you make such a reduction?" "We do it by keeping cost sheets of everything and by watching the leaks and stopping them. It is the duty of the engineer not only to design and construct, but to design and construct economically. That is what we are trying to do here at Panama."

"But are not the wages on the canal excessively high, and can they be so maintained in the future?"

"The wages here were fixed at the beginning of the work, and it would have been difficult to change them in the process of construction. The chief thing about this work was that it had to be done well, and done quickly, and everything else had to be subordinate to that. As it is now, there will probably be a change in the wage scale, and this should be arranged for by Congress at its present session. If Congress will act, we shall be able to select the operating force from our present employees, and this will be a great saving as to time, money and in other respects. Congress should fix the wage scale for the positions of the permanent operating force, doing away with the inequalities which now exist. As it is, some of our present wages have been made in connection with organized labor, and the unions have succeeded in increasing the wages of certain classes far above what is paid to others of like character. For instance, some kinds of labor are receiving 85 per cent. more than similar labor in the United States, while other classes, equally capable, have had an increase of only 15 or 20 per cent. My idea would be to make a fixed percentage of increase, say 25 per cent. over the wages of similar labor in the eastern part of the United States, where the labor scale is the highest. This matter should be fixed at once, in order that we may be able to hold the best men of our construction force. Good labor does not go begging, and if not so held these men will soon have secured permanent jobs elsewhere."

**Some Lessons of the Canal.** "Has the world learned any new things through the construction of this canal?"

"Yes, I think it has," said Colonel Goethals. "It has learned a great deal about how to take care of one's health in the tropics, and in general sanitation. It does not mean that the canal has taught the world anything as to malaria and yellow fever, as far as the mosquitoes are concerned, or of the methods of destroying those insects. These discoveries were made by others, and in other parts of the world. It was an English army surgeon who brought to light the fact that the malarial mosquito transmitted malaria. He found

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\$15,000,000. At the present time we are expecting to save from \$15,000,000 to \$20,000,000 on the estimated cost."

"How can you make such calculations as to a job of these mighty dimensions?"

"It is very simple," said Colonel Goethals. "We make our measurements and estimate the quantity. Then from the records of similar work elsewhere we can fix the cost per unit of cubic yard of excavation or construction or pound of steel work, and by the ordinary courses of arithmetic find just what it should be. In the present case the unit prices were those adopted by the board of contracting engineers for 1906."

"Have you kept within those prices?"

"Yes, we have cut most of them very considerably. Take the unit price of the concrete. The engineers put that at \$8 per cubic yard. We are making the locks in the spillway at Gatun for \$7 a cubic yard and on the Pacific division we have got the concrete work down to \$5 a cubic yard. You may know what that means when you remember that we shall use over 2,000,000 cubic yards at Gatun and over 2,800,000 on the Pacific division. This means a saving of at least \$2,000,000 at Gatun and of \$1,500,000 on the Pacific. Altogether, it is a saving of \$3,500,000. But that is a saving on but one unit price. We have done equally well in others."

**Watching the Leaks and Scientific Management.**

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it in India, and proved its agency some years before we began our work here."

"The yellow fever mosquito was discovered by our own army doctors in Cuba, and the means of suppressing both were developed at Havana. It was here, however, that the use of these discoveries was first employed on a large scale, and by that means forced upon the attention of the world. We have shown that by proper attention to vegetation and drainage, by the use of coal oil on stagnant water and by having the quarters properly screened almost any tropical region can be made a workable quantity."

"And then we have to some extent made improvements in machinery for use in great works like this. But in that respect we have not done so much as we might have done had the necessity for quick work not been so great. As it is, we have had to fight for speedy results, and for that reason could not experiment with the many new inventions offered to us. Indeed, where we have tried such inventions they have delayed rather than aided the work."

**The Opening of the Canal.**

"Can you not tell me the time when the canal will be surely opened for the traffic of the world?"

"I cannot give you the exact date when the first ship will go through. The President has definitely fixed the formal opening for January 1, 1915, when he has invited the navies of the world to meet at Fortress Monroe, and leaving there go in one grand procession through the canal. We must prepare for that time, and I feel sure that we will then have the canal in such shape that the mighty fleet can pass through without a hitch. To do that we shall complete the canal as soon as possible, and will send any kind of shipping through it until the formal opening comes, in order that the machinery and the operating force may be in perfect working order when the great time comes."

With this statement I close the first half of my interview with Colonel Goethals. Our talk about the canal lasted for several hours, and the remainder of it is even more interesting than that I have given. It relates to the fortification of the canal, and as to how the zone should be controlled. It deals with the tolls of our canal and those of Suez, and it questions how much American shipping should pay. It has to do with the permanent operating force, the traffic and with other subjects of the most vital interest. That story I will give you next week.

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